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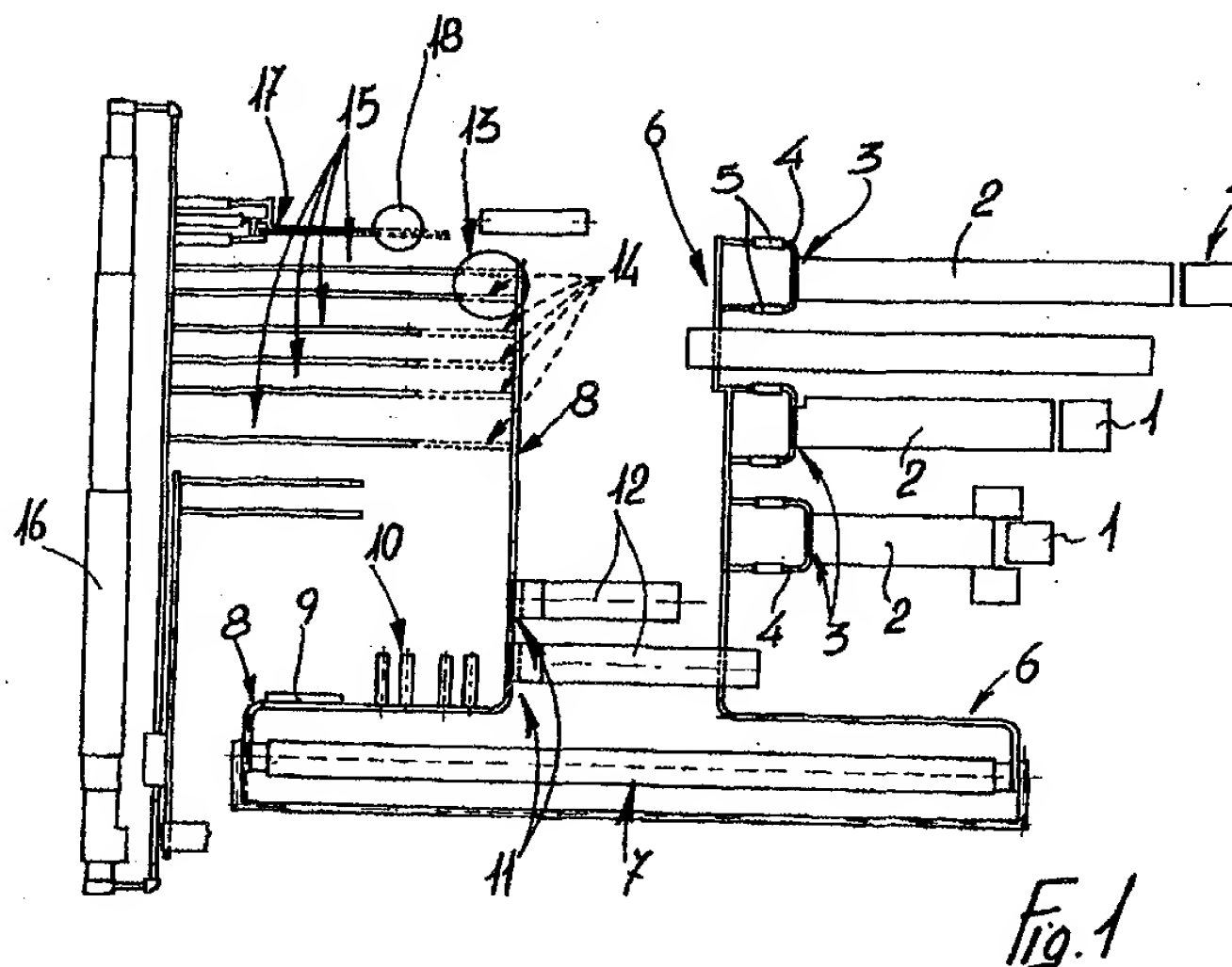
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(54) **Process and apparatus for manufacturing ceramic products.**

(57) The process and apparatus relates to manufacturing ceramic products, and particularly crockery. The process comprises various steps including forming and first drying of a mix for obtaining semi-finished crockery items which are subjected to a first dynamic storage, and then conveyed according to a standardized and preset flow. The baking of the semiworked items then occurs in order to obtain

semi-finished products which are subjected to a second automatic conveyance, to an integrity check and to a verification of their arrangement according to a required sequence. A third automatic conveyance then occurs in order to achieve the enamelling and/or glazing of the semi-finished crockery items, so as to obtain finished products which are finally unloaded and subjected to a quality control.



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The present invention relates to a process for manufacturing ceramic products such as dishes and/or crockery.

The known production process for manufacturing porcelain and vitreous china is currently conventionally divided into two baking steps, the first one being termed biscuit baking and the second one being termed glazing.

This known production process is essentially related to manual intervention for effecting all transfers and movements of material. In fact, the term "manufactory", which is used to describe the workplaces which use these production processes, derives from this manual action.

The time required to obtain the finished products is also conditioned by the presence of product baking kilns, which are conventionally tunnel type kilns.

The baking cycle can usually last from twenty to forty hours for each tunnel kiln used, and such tunnel kilns, due to their extrinsic nature, have been found to be scarcely suitable for the purpose of achieving an automated production process.

As well as the baking cycle or kiln-firing cycle, the product itself has a very long factory transit cycle, since several treatments are required for manufacturing the finished product.

In known production processes, the product has a factory transit cycle which, in the best of cases, is approximately five days, and can rise to even longer time spans.

Furthermore, since processing is usually discontinued at weekends, further storage of the product on trolleys is necessary.

This storage, besides implying considerable personnel requirements, also unavoidably leads to a large number of rejected products due to the continuous handling of the products.

The aim of the present invention is therefore to eliminate the disadvantages described above in known types of processes and apparatuses for manufacturing ceramic products by providing a process and an apparatus which, starting from a mix, allow to obtain finished dishes and/or crockery in very modest times.

Within the scope of the above aim, an important object is to provide a process and an apparatus for manufacturing ceramic products which preserve the products as much as possible from manual interventions during the various treatment steps, thus reducing production costs as well as the quantity of rejected products.

Another important object is to obtain a process and apparatus for manufacturing ceramic products which associate with the preceding characteristics that of obtaining dishes and/or crockery which, despite the contraction of the production cycle, have optimum finishing characteristics which are

typical of the longer known production processes.

According to one aspect of the invention this aim, these objects and others which will become apparent hereinafter are achieved by a process for manufacturing ceramic products, particularly for manufacturing crockery, characterized in that it comprises the following steps:

- a) forming a mixture for obtaining semiworked crockery items;
- b) first dynamic storage of said semiworked items;
- c) first automatic conveyance of said semiworked items according to a standardized or preset flow;
- d) drying and baking said semiworked items to obtain semi-finished crockery items;
- e) second automatic conveyance of said semi-finished crockery items according to a preset flow;
- f) third automatic conveyance of said semi-finished crockery items;
- g) enamelling and/or glazing of said semi-finished crockery items to obtain finished crockery; and
- h) unloading said finished crockery.

According to another aspect of the invention, this aim, these objects and others which will become apparent hereinafter are achieved by an apparatus for manufacturing ceramic products, particularly for manufacturing crockery, characterized in that it comprises:

- a) means for forming a mixture for obtaining semiworked dishes and/or crockery;
- b) first dynamic storage means for storing said semiworked items;
- c) first automatic conveyance means for transporting said semiworked items according to a standardized or preset flow;
- d) means for drying and baking said semiworked items to obtain semi-finished dishes and/or crockery;
- e) second automatic conveyance means for transporting said semi-finished items according to a preset flow;
- f) third automatic conveyance means for transporting said semi-finished items;
- g) means for enamelling and/or glazing said semi-finished items to obtain finished crockery items; and
- h) unloading means for automatically unloading said finished crockery items.

Further characteristics and advantages of the invention will become apparent from the detailed description of a particular but not exclusive embodiment, illustrated only by way of non-limitative example in the accompanying drawings, wherein figure 1 is a schematic view of a preferred embodiment of the apparatus, with reference to the se-

quential nature of the process.

With reference to the above-cited drawing figure, the process for manufacturing ceramic products such as dishes and/or crockery comprises a mix forming step.

One or more forming units, indicated by the numeral 1, may thus be provided; said forming units unload the semiworked dish and/or crockery item directly at one or more adjacent drying kilns, indicated by the numeral 2.

Advantageously, one or more finishing units, indicated by the numeral 3, may be provided at the output of said one or more drying kilns 2; said finishing units, or the drying kilns themselves, unload the semiworked dishes and/or crockery at first conveyor belts, indicated by the numeral 4.

Isostatic presses may be provided as an alternative to the forming units and are also arranged downstream of the finishing units.

The semiworked dishes and/or crockery items then undergo a first dynamic storage at one or more adapted rotating storage units 5 which are interposed at the first conveyor belts 4.

Said rotating storage units 5 can be for example constituted by a lifting unit, which removes each semiworked dish and/or crockery item and returns each individual product, according to preset timings, onto the first conveyor belts 4 for the subsequent treatments.

The process in fact provides a first automatic conveyance of the semiworked products at a first conveyor 6, to which the various first conveyor belts 4, connected to the drying kilns 3, converge.

The first conveyor 6 then allows to pass the dishes and/or crockery items to the subsequent step of the process according to a standardized or preset flow by virtue of the presence of the rotating storage units 5.

The process in fact subsequently provides the drying and baking of the semiworked items at a first kiln 7 of the single-layer roller type.

Advantageously, the first conveyor 6 can have one or more working levels, i.e. it can convey along preferential channels the dishes and/or crockery items removed from the various drying kilns, depositing said dishes and/or crockery items at devices for introducing them into the first kiln 7 which are also arranged along different levels.

The first kiln 7 is thus advantageously a single-layer roller baking kiln which is capable of ensuring the characteristics and the quality required by the material to be produced.

Semi-finished dishes and/or crockery items are obtained at the output from the first kiln 7; the process then provides a second automatic conveyance of said semi-finished dishes and/or crockery items by means of a second conveyor 8 at which the nature of the dish is initially detected by read-

ing its dimensions; said reading action is performed in a first station 9.

This also allows to identify possible breakages of individual dishes and/or crockery items, thus allowing their possible elimination from the production cycle.

The arrangement of the semi-finished dishes and/or crockery items according to a preset sequence is subsequently also possibly checked by using adapted sorting units 10, the function whereof is to remove the individual dishes and/or crockery items from the second conveyor 8, returning them to it according to a required sequence.

After the sorting units 10, the process optionally provides one or more second stations 11 adapted for spacing, according to a preset pitch, the individual dishes and/or crockery items prior to their conveyance at one or more buffer storage units 12.

Said buffer storage units allow to perform a temporary storage of the product prior to the subsequent treatment steps.

Conveniently, one or more third stations 13 for the removal of the broken dishes and/or crockery items or for the adjustment of the flow thereof may be provided at the terminal end of the second conveyor 8.

The process then provides a third automatic conveyance of the semi-finished dishes and/or crockery items, by means of one or more third conveyors 14, to one or more glazing units 15 and subsequently to a second kiln 16 in which the glaze applied on the dishes and/or crockery items is baked.

Finished products are thus obtained and are conveyed at second conveyor belts 17 which in turn convey the finished dishes and crockery items to a fourth station 18 in which a quality control is performed thereon.

It has thus been observed that the process has achieved the intended aim and objects, a continuous cycle having been provided in all the production steps starting from the mixing step up to the product quality control step.

The use of the conveyors and of the conveyor belts in fact allows optimum and immediate linkage between the various units which perform the steps of the process without performing any manual intervention and thus optimizing work times.

This process has been found to allow an overall transit time (starting from the mixing up to the finished product quality control) of approximately five hours without manual operations except for the indicated checks and selection.

The process is naturally susceptible to numerous modifications and variations, all of which are within the scope of the same inventive concept.

The individual machines used may also be the

most appropriate according to the specific requirements.

Thus, for example, the first kiln 7 and the second conveyor 8 can have multiple levels for the conveyance of the dishes and/or crockery items in order to allow the processing of a plurality of varieties of dishes and/or crockery items, temporarily storing one or more thereof at the buffer storage units 12.

Furthermore, the presence of the sorting units 10 can also allow to select one or more types of dishes and/or crockery items in output from the first kiln 7 and to send one or more thereof directly to the buffer storage units 12 or to the glazers 15.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Process for manufacturing ceramic products, characterized in that it comprises the following steps:

- a) forming a mixture for obtaining semiworked crockery items;
- b) first dynamic storage of said semiworked items;
- c) first automatic conveyance of said semiworked items according to a standardized or preset flow;
- d) baking of said semiworked items to obtain semi-finished crockery items;
- e) second automatic conveyance of said semi-finished crockery items according to a preset flow;
- f) third automatic conveyance of said semi-finished crockery items;
- g) enamelling and/or glazing of said semi-finished crockery items to obtain finished crockery; and
- h) unloading said finished crockery.

2. Process according to claim 1, characterized in that said second automatic conveyance of said semi-finished crockery items according to a preset flow is followed by the subsequent steps of;

verification of the integrity of said semi-finished crockery; and

arranging the semi-finished crockery according to a required sequence.

3. Process according to claim 1, characterized in

that said enamelling and/or glazing of said semi-finished crockery for the obtainment of finished crockery is subsequently followed by a finished-product baking step and a quality control step.

4. Process according to one or more of the preceding claims, characterized in that said forming step comprises the shaping and a first drying of a mix for the obtainment of said semi-finished crockery items, said crockery being subsequently subjected to a finishing treatment at one or more adjacent drying kilns.

5. Apparatus for manufacturing ceramic products, particularly for manufacturing crockery, characterized in that it comprises:

- a) means for forming a mixture for obtaining semiworked dishes and/or crockery;
- b) first dynamic storage means for storing said semiworked items;
- c) first automatic conveyance means for transporting said semiworked items according to a standardized or preset flow;
- d) means for drying and baking said semiworked items to obtain semi-finished dishes and/or crockery;
- e) second automatic conveyance means for transporting said semi-finished items according to a preset flow;
- f) third automatic conveyance means for transporting said semi-finished items;
- g) means for enamelling and/or glazing said semi-finished items to obtain finished crockery items; and
- h) unloading means for automatically unloading said finished crockery items.

6. Apparatus according to claim 5, characterized in that it comprises at least one shaping machine, constituted by at least one forming unit which directly conveys said semi-finished crockery items to at least one adjacent drying kiln, and means for conveying said crockery items from said drying kiln to at least one finishing unit.

7. Apparatus according to one or more of claims 5, 6, characterized in that said forming unit comprises at least one isostatic press having means for directly conveying said semi-finished crockery to one or more adjacent finishing units.

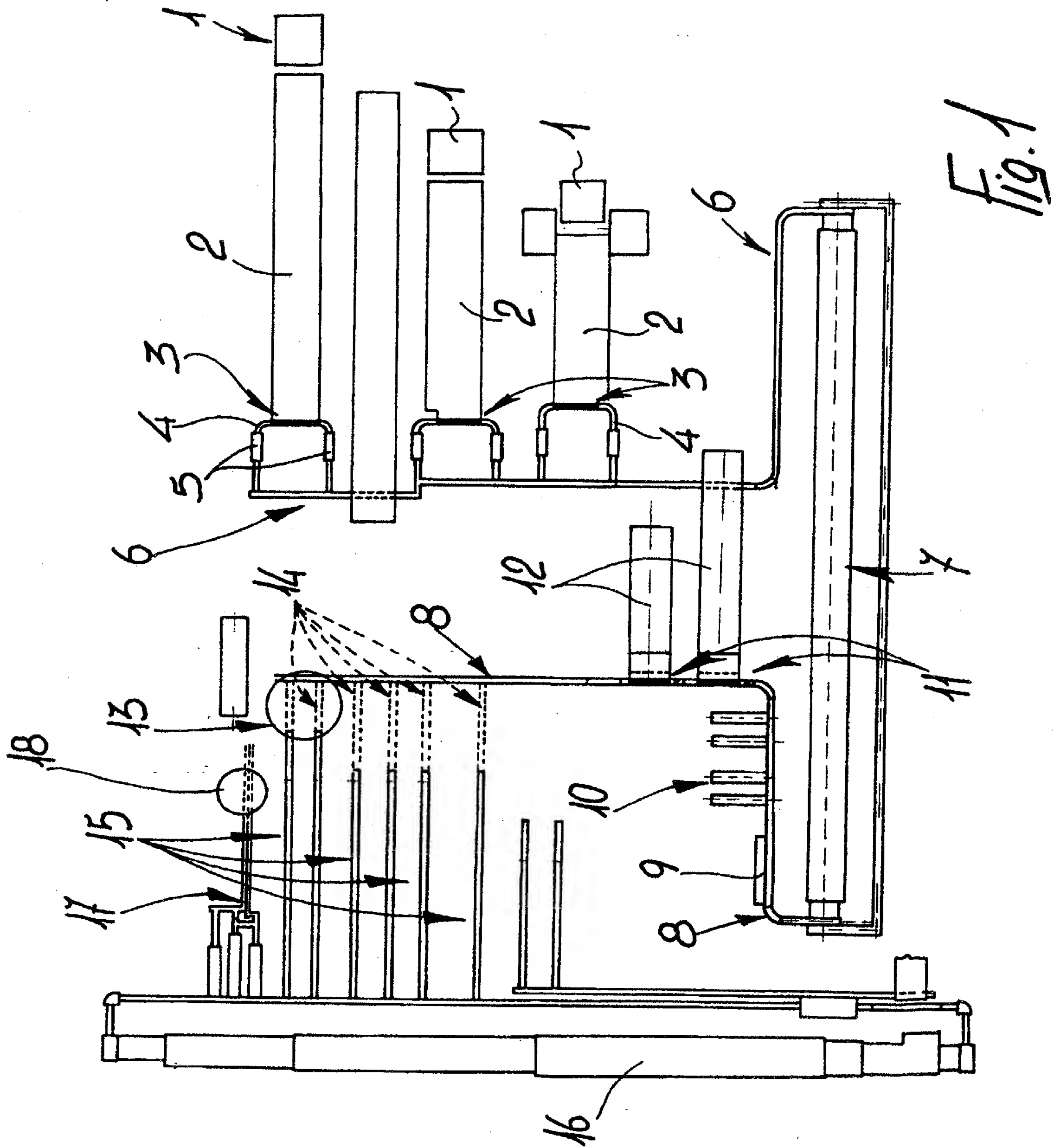
8. Apparatus according to one or more of claims 5-7, characterized in that at the output from said finishing units, which are sequential with respect to said forming units, said semiworked

dishes and/or crockery items are unloaded at first conveyor belts.

9. Apparatus according to one or more of claims 5-8, characterized in that said semiworked dishes and/or crockery items are subjected to a first dynamic storage at one or more adapted rotating storage units which are interposed at said first conveyor belts.
10. Apparatus according to one or more of claims 5-9, characterized in that said rotating storage units are constituted by a lifting unit, which removes each semiworked dish and/or crockery item and returns, according to preset times or sequences, each individual product onto said first conveyor belts for subsequent treatments.
11. Apparatus according to one or more of claims 5-10, characterized in that said first automatic conveyance of said semiworked items according to a standardized preset flow occurs by means of a first conveyor which has one or more working levels suitable for conveying along preferential channels said dishes and/or crockery items removed from said finishing units, depositing said dishes and/or crockery items at adapted feeding devices for the subsequent baking step.
12. Apparatus according to one or more of claims 5-11, characterized in that said baking of said semiworked items occurs at an adapted first single-layer roller kiln which operates on one or more work levels arranged approximately parallel to one another, said work levels being equal or different in number with respect to said preferential channels of said first conveyor.
13. Apparatus according one or more of claims 5-12, characterized in that said first kiln is constituted by a single-layer roller baking kiln for obtaining semi-finished dishes and/or crockery.
14. Apparatus according to one or more of claims 5-13, characterized in that said second automatic conveyance of said dishes and/or crockery occurs by means of a second conveyor which removes said dishes and/or crockery items from said first kiln, conveying them to a first station at which the nature of the dish is read.
15. Apparatus according to one or more of claims 5-14, characterized in that possible breakages of individual dishes and/or crockery items are

identified at said first station, said dishes and/or crockery items being possibly eliminated from the production cycle.

16. Apparatus according to one or more of claims 5-15, characterized in that the arrangement of said semi-finished dishes and/or crockery items according to a preset sequence is checked at said first station by using adapted sorting units which remove from said second conveyor said individual dishes and/or crockery items, returning them therein according to a required sequence.
17. Apparatus according to one or more of claims 5-16, characterized in that one or more second stations are present after said sorting units and are suitable for spacing, according to a preset pitch, said individual dishes and/or crockery items prior to their conveyance at one or more adapted buffer storage units which are suitable for allowing a temporary storage of the product prior to the subsequent processing steps.
18. Apparatus according to one or more of claims 5-17, characterized in that one or more third stations for the removal of said broken dishes and/or crockery items or for the adjustment of the flow thereof are present at the terminal end of said second conveyor.
19. Apparatus according to one or more of claims 5-18, characterized in that said third automatic conveyance of said semi-finished dishes and/or crockery items occurs by means of one or more third conveyors which send said dishes and/or crockery items to one or more glazers and subsequently to a second kiln, in which the baking of the enamel occurs, in order to obtain said finished dishes and/or crockery items.
20. Apparatus according to one or more of claims 5-19, characterized in that said finished products are conveyed at second conveyor belts which in turn convey said finished dishes and/or crockery at a fourth station in which a quality control is performed thereon.



(19)



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(54) **Process and apparatus for manufacturing ceramic products.**

(57) The process and apparatus relates to manufacturing ceramic products, and particularly crockery. The process comprises various steps including forming (1) and first drying (2) of a mix for obtaining semi-finished crockery items which are subjected to a first dynamic storage (5), and then conveyed (6) according to a standardized and preset flow. The baking (7) of the semiworked items then occurs in order to obtain semi-finished products which are

subjected to a second automatic conveyance (8), to an integrity check and to a verification (9) of their arrangement according to a required sequence. A third automatic conveyance (14) then occurs in order to achieve the enamelling and/or glazing (15) of the semi-finished crockery items, so as to obtain finished products which are finally unloaded and subjected to a quality control.

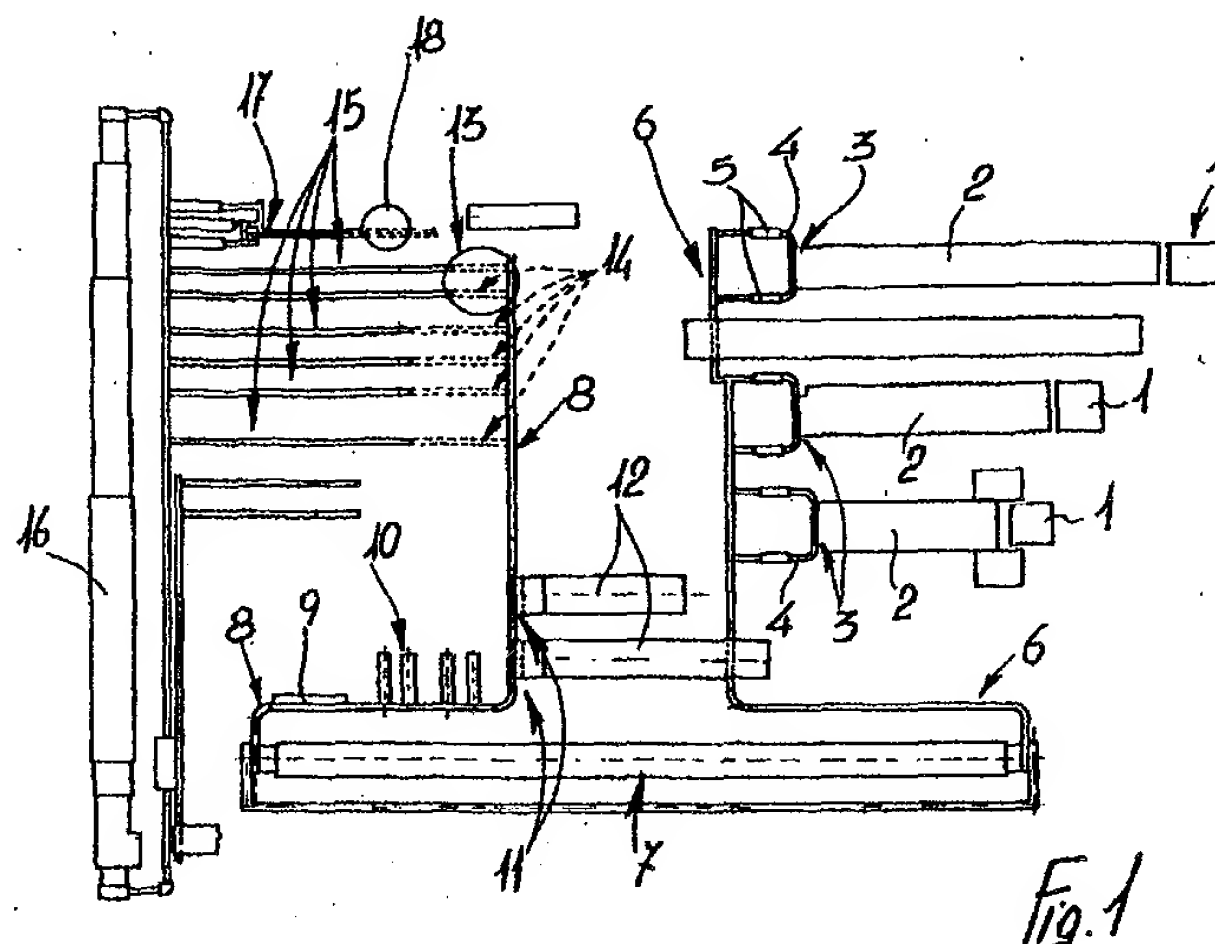


Fig. 1

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European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 91 10 9607

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL.5)
A	EP-A-0 059 002 (IDEAL STANDARD S.P.A.) * the whole document *	1-20	B28B15/00
A	GB-A-1 138 713 (SOCIETA CERAMICA ITALIANA RICHARD-GINORI S.P.A.) * page 2, line 31 - page 3, line 12 *	1-6, 8, 12, 20	
A	FR-A-1 559 015 (CERAMICA FILIPPO MARAZZI S.P.A.) * page 2, column 2, line 22 - page 3, column 1, line 15 *	1-6, 18-20	
A	DE-A-3 942 666 (NGK INSULATORS LTD.) * figure 1 *	5, 7	
A	SOVIET INVENTIONS ILLUSTRATED Week K40, 16 November 1983 Derwent Publications Ltd., London, GB; AN 83-781123 & SU-A-977 183 (BUILD CERAMICS INST) 11 December 1982 * abstract *	5, 15, 18	
			TECHNICAL FIELDS SEARCHED (Int. CL.5)
			B28B C04B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10 JUNE 1992	Examiner LANASPEZE J. P. Y.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons * : member of the same patent family, corresponding document			